

THE MALE GENITALIA OF BLATTARIA.  
VI. BLABERIDAE: OXYHALOINAE\*

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Princis (1965) included the following genera in the Oxyhaloidea: *Oxyhaloa* Brunner, *Griffiniella* Karny, *Nauphoeta* Burmeister, *Henschontedenia* Princis, *Jagrehnia* Princis, *Coleoblatta* Hanitsch, *Pronauphoeta* Shelford, *Leucophaea* Brunner, *Pelloblatta* Rehn, *Heminauphoeta* Saussure, *Gromphadorhina* Brunner, *Ateloblatta* Saussure, and *Aeluropoda* Butler. In this paper I shall illustrate the male genitalia of 8 of the above genera. I have not seen males of *Coleoblatta*, *Heminauphoeta*, and *Ateloblatta*. Princis (1961) included *Pronauphoeta* and *Pelloblatta* with a (?) in the Oxyhaloidea but did not question their placement in this family in his Catalogus (Princis, 1965). The male genitalia and subgenital plate of *Pronauphoeta* are so different from other members of the Oxyhaloidea [I follow McKittrick (1964) in using subfamily rather than family rank], that I do not include it in this subfamily. I have placed *Pelloblatta* in the Panchlorinae (Roth, 1971).

The genus *Ploceophilus* Rehn was placed by Rehn (1965) in the Oxyhaloidea; it includes one species, *P. kohlsi* Rehn which lives in the communal nests of the Social Weaver Bird in southwest Africa. According to Rehn (1965) the species is related to *Oxyhaloa*, and he stated that *Ploceophilus* could be separated from *Griffiniella* by its [*Ploceophilus*] lappet-like tegmina and absence of wings in both sexes. However, Princis (personal communication) believes that Rehn was wrong in his interpretation of *Griffiniella* and that *Ploceophilus kohlsi* is actually *Griffiniella heterogamia* Karny.

MATERIALS AND METHODS

The male genitalia of museum specimens were treated with 10% KOH, dehydrated, cleared in xylol and mounted in Permount.

The source of each of the specimens whose genitalia are illustrated is given using the following abbreviations: (AMNH) = American Museum of Natural History, New York; (ANSP) = Academy of Natural Sciences, Philadelphia; (BMNH) = British Museum

\*Manuscript received by the editor June 4, 1970.

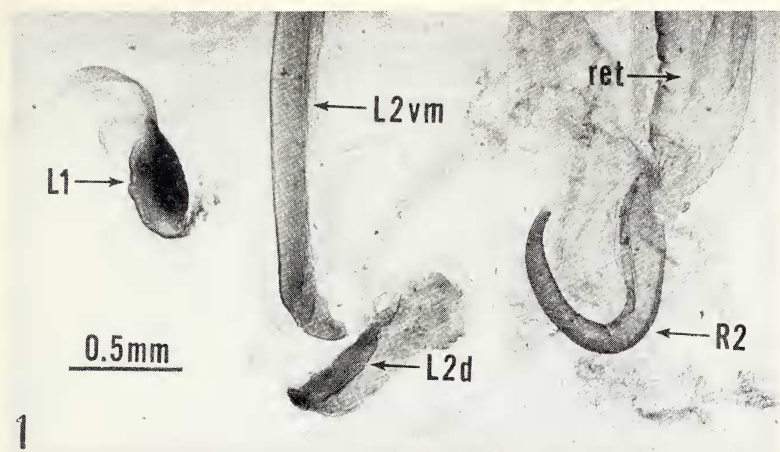


Fig. 1. Male genitalia of *Nauphocta cinerea* (Olivier) (dorsal view). L1 = first sclerite of left phallomere; L2vm = median sclerite of left phallomere (L2 ventromedial); L2d = dorsal sclerite of L2; R2 = hooked sclerite of right phallomere; ret = retractable portion of R2 which lies in a membranous sheath.

(Natural History), London; (CSIRO) = Division of Entomology, CSIRO, Canberra, Australia; (CUZM) = Copenhagen University, Zoological Museum, Denmark; (L) = Zoological Institute, Lund, Sweden; (N) = U. S. Army Natick Labs., Natick, Mass.; (USNM) = United States National Museum, Washington, D. C. The number preceding the abbreviations refers to the number assigned the specimen and its corresponding genitalia (on a slide) which are deposited in their respective museums.

#### RESULTS AND DISCUSSIONS

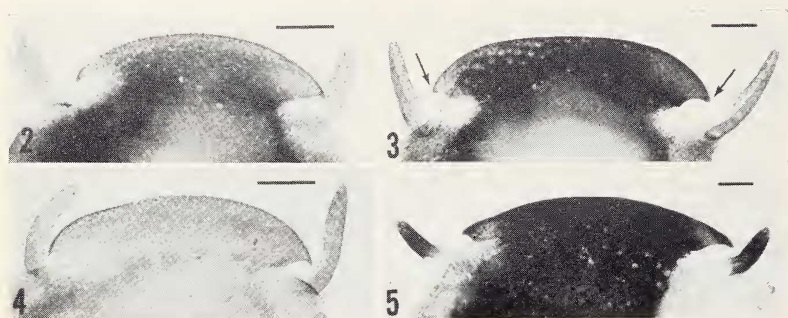
Princis (1961, p. 444) used the male subgenital plate as his final key character in distinguishing the Oxyhaloidae. This plate has a laterally directed recurved pointed projection posterior to each stylus (Figs. 2-5; arrows in 3). McKittrick (1964, p. 45) suggested that this shape may be the closest to the ancestral type and that all other shapes of subgenital plates in the Blaberidae could be derived from it by differential reduction. The subgenital plate is an excellent character for distinguishing Oxyhaloinae because the internal genitalia (Fig. 1) of the 8 genera used in this study are all basically similar. The L2d is separated from L2vm, and is a sclerotized plate

which is an integral part of the preputial membrane. The prepuce has no distinctive shape, other than this sclerotization. The L1 is markedly reduced and, in most species, its sclerotization is restricted mainly to the region of the cleft. The tip of the genital hook (R2) is more lightly sclerotized than the main body of the hook, and in some species is a separate pointed or rounded lobe which may break off. Gurney (1965) has drawings of the genital hooks of *Nauphoeta cinerea* and three species of *Henschoutedenia*, but erred in indicating that they are part of the left phallomere.

The genera listed earlier are arranged linearly according to Princis (1965). The genitalia are essentially so basically similar in the genera studied here that there is little reason to alter this arrangement. However, there are certain differences in structure of L2d and R2 which allow the genera to be placed into three tribes.

1. Oxyhaloini (*Oxyhaloa*) (Figs. 29-46). Characteristically the upper right side of the L2d is extended into a long relatively narrow arm (Figs. 29, 32, 35, 38, 41, 44). The genital hook (R2) differs from all other genera of Oxyhaloinae. The rounded outer surface has minute setae and the apical lobe appears to arise from the dorsal surface as a thinly sclerotized membrane and extends from behind the tip of the darkly pigmented hook (Figs. 30, 33, 36, 39, 42, 45).

2. Nauphoetini (*Griffiniella*, *Nauphoeta*, *Henschoutedenia*, *Leucophaca*, and *Jagrehnia*) (Figs. 6-25, 47-139). The curved genital



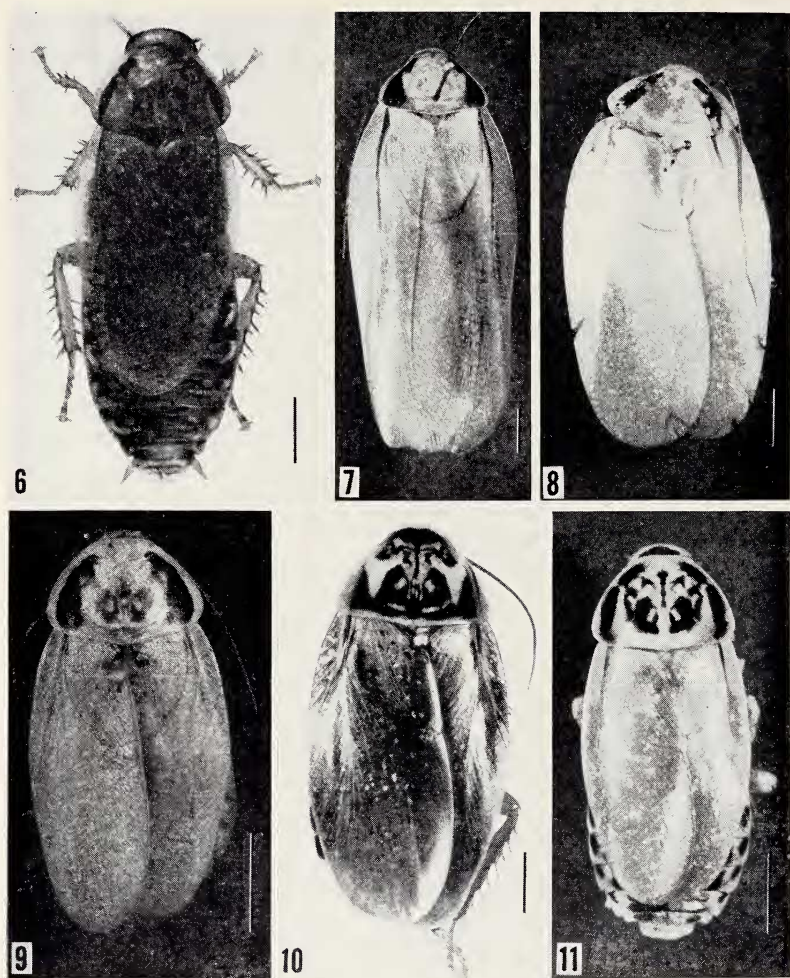
Figs. 2-5. Male subgenital plates of Oxyhaloinae (ventral views). 2. *Nauphoeta cinerea*. 3. *Leucophaca maderae* (Fab.). 4. (188 USNM) *Henschoutedenia sordida* (Shelford) (Allotype of *Nauphoeta proccera* Rehn). Mt. Coffee, Liberia. 5. *Gromphadorhina brunneri* Butler. Madagascar. (scale = 0.5 mm).

hook is usually relatively slender and its tip in some species appears to be a distinct joint attached to the main body of the hook, or it is a more lightly pigmented point which blends into and is an integral part of R2 (Figs. 120, 123, 126, 129). Gurney (1965, p. 11) stated that in *N. cinerea*, *H. procera*, *H. flexivitta*, and *H. tectidoma* the genital hook differed “. . . in closeness of the apex to the opposite base, and in the position and shape of the flange near the base.” The flange (Fig. 72, f) is found in *Leucophaea* and *Jagrehnia*, but may be poorly developed (Figs. 81, 105) or absent (Figs. 129, 132, 135, 138) in some species of these genera.

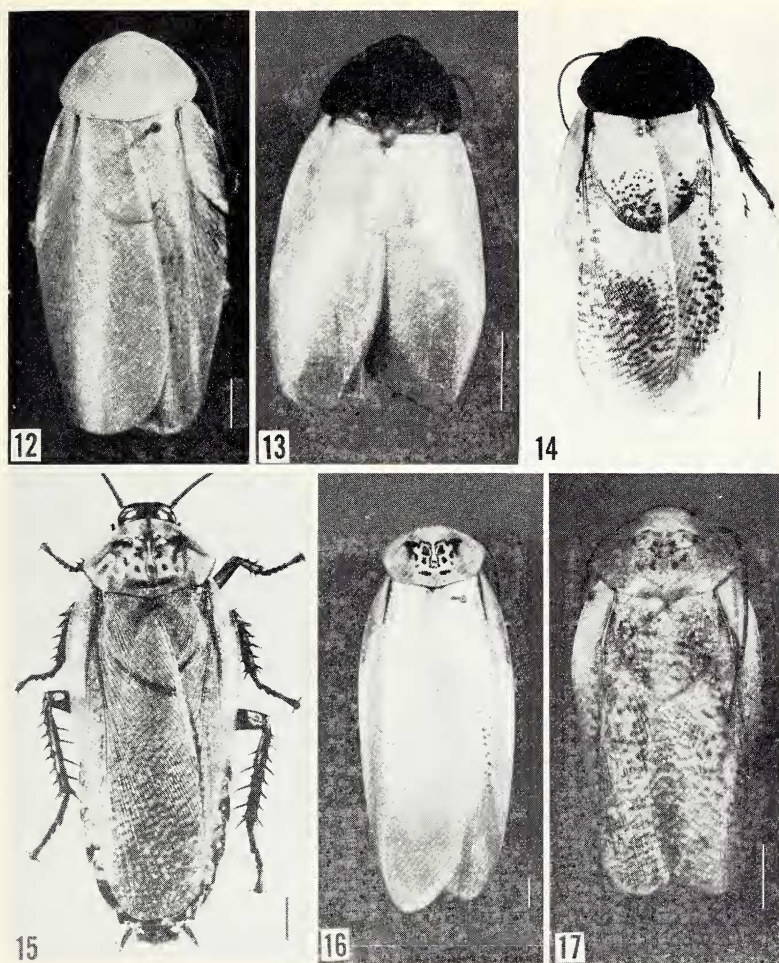
In *Jagrehnia idonea* and *J. madecassa*, R2 appears to be closer to the Gromphadorhini (see below) than to other species of *Jagrehnia*. Apparently the tips have been broken off (Figs. 132, 135, 138) and these resemble the damaged genital hooks (Figs. 155-157) of *Gromphadorhina*. The genital hooks of *Jagrehnia* can be arranged to show a trend from an elongated slender form (Fig. 111) to a stouter (Fig. 129) more robust shape (Fig. 138) approaching that found in the Gromphadorhini (Fig. 157). *Jagrehnia idonea*, *J. madecassa*, and *Gromphadorhina* spp. are all Malagasy species.

3. Gromphadorinini (*Gromphadorhina*, *Aeluropoda*) (Figs. 26-28, 140-157). In this tribe the retractable portion of R2 is unusually short and therefore cannot be extruded to the same extent found in other genera of Oxyhaloinae (and most other species of Blaberidae). The genital hook is robust, black, and the tip is lightly pigmented and resembles a nonarticulated segment. In *Gromphadorhina* there is a distinct indentation on the inside margin between the tip and main body of the hook (Figs. 144 [arrow], 147, 150, 153).

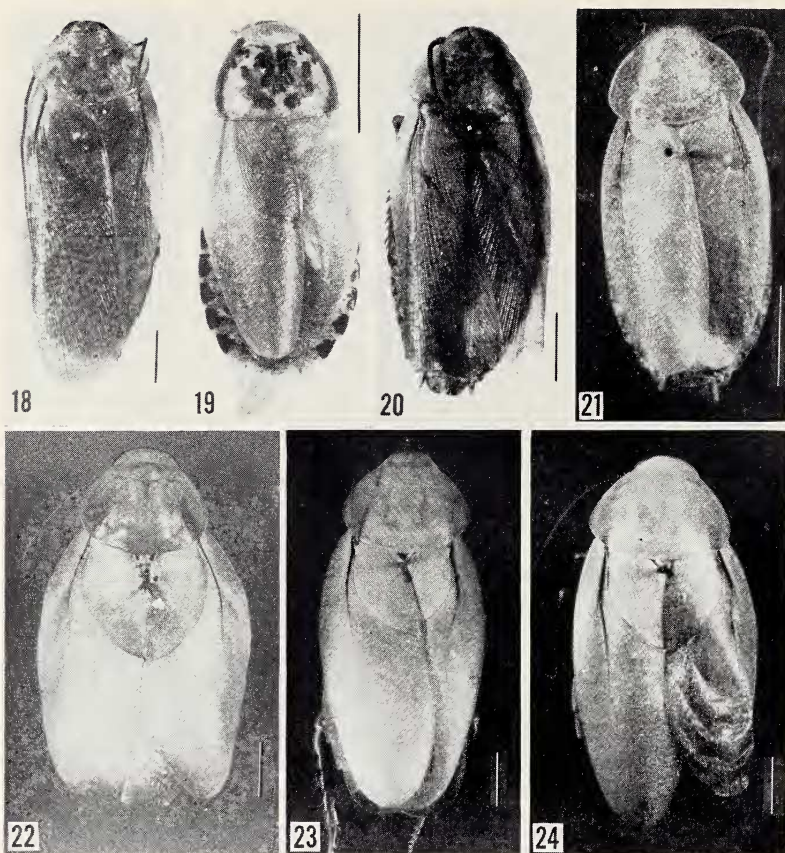
The retractable portion of R2 (Fig. 1, ret) of males of *Blattaria* in which females mount and palpate his dorsum prior to copulation, is relatively long. Thus, the genital hook is extruded for a considerable length and is used in the initial seizure, or to pull down the female's subgenital plate while she is above him. The short retractable portion of R2 in *Gromphadorhina* probably is correlated with the difference in precopulatory behavior of this genus. In *G. portentosa* the female does not mount and palpate the male's dorsum during courtship; the male simply backs into the female to make connection (Barth, 1968). Nothing is known about the mating behavior of *Aeluropoda*, but it may be similar to *Gromphadorhina*.



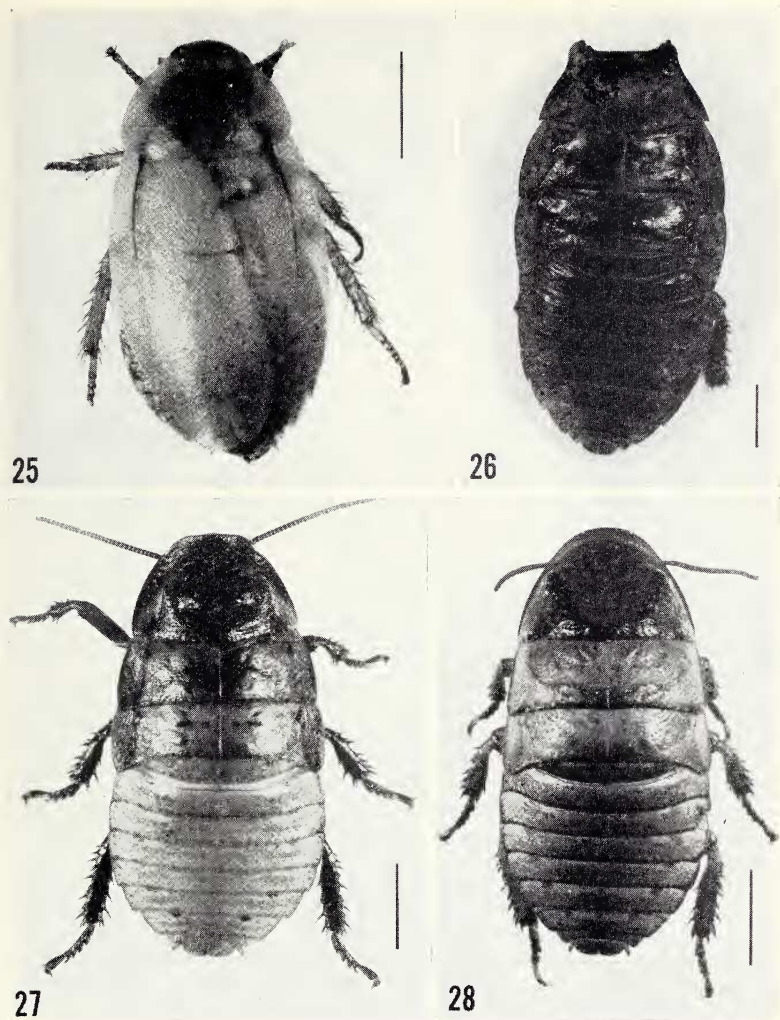
Figs. 6-11. Adult male Oxyhaloinae. 6. *Nauphoeta cinerea*. 7. (28 CUZM). *Henschoutedenia elegans* (Shelford). Cameroon Republic (det. Princis). 8. (1450 L). *Henschoutedenia mombuttu* (Rehn). Usambara, Nguelo, Tanganyika (det. Princis). 9. (134 ANSP). *Henschoutedenia flexivitta* (Walker). Ruanda (det. Rehn). 10. (1451 L). *Henschoutedenia occidentalis* (Fab.). (det. Princis). 11. (1452 L). *Henschoutedenia tectidoma* Gurney. Probably from Cameroon Republic. (det. Princis). (scale = 5 mm).



Figs. 12-17. Adult male Oxyhaloinae. 12. (133 ANSP). *Henschoutedenia epilamproides* (Shelford). Yaounda, Cameroon, West Africa (det. Rehn). 13. (1453 L). *Henschoutedenia bicolor* (Shelford). Cameroon Republic (det. Princis). 14. (131 ANSP). *Leucophaea capelloi* (Bolivar). Kafakumba, Congo (det. Rehn). 15. *Leucophaea maderae*. 16. (128 ANSP). *Leucophaea grandis* (Saussure). Entebbe, Uganda. 17. (1460 L). *Leucophaea pustulata* (Hanitsch). Bunduki-Uluguru Mts., Tanganyika Terr. (det. Princis). (scale = 5 mm).

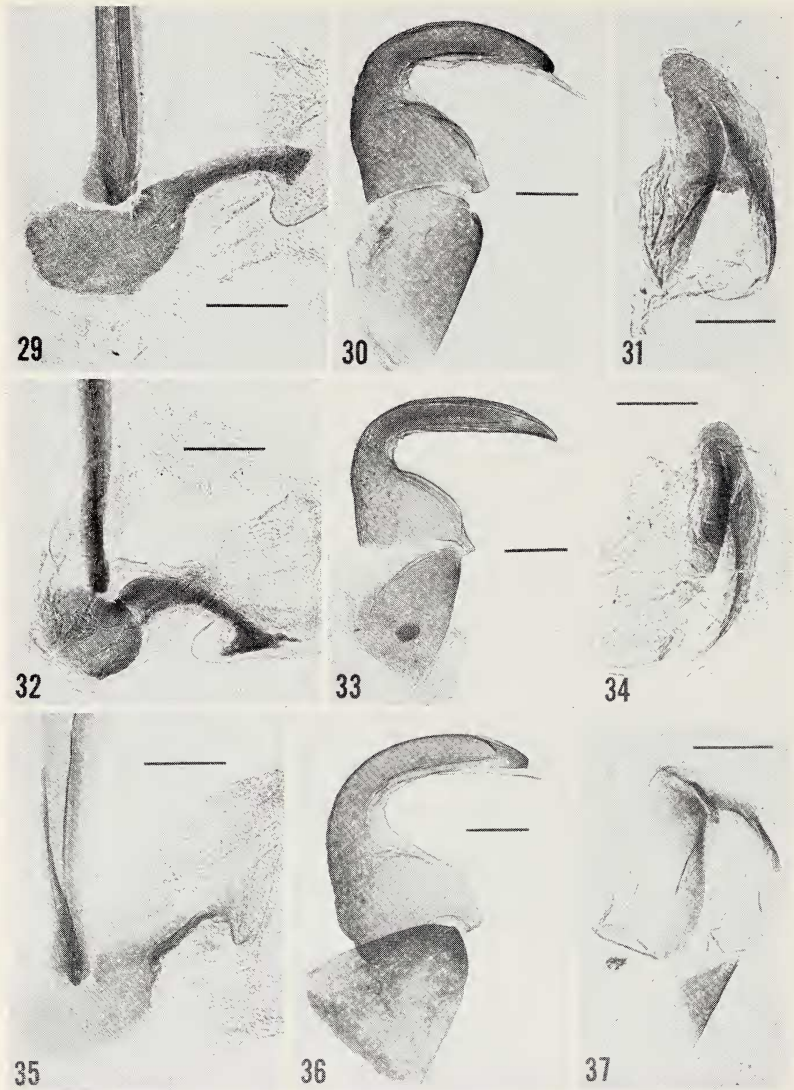


Figs. 18-24. Adult male Oxyhaloinae. 18. (152 ANSP). *Leucophaea puerilis* Rehn. Paratype. Duala, Cameroon Republic. 19. (1454 L). *Jagrehnia minuta* (Shelford). East Africa. (det. Princis). 20. (162 ANSP). *Jagrehnia gestroiana* (Saussure). (det. by Rehn as *Nauphoeta sudanensis* Werner, a synonym). Northeast Africa. 21. (1457 L). *Jagrehnia madecassa* (Saussure). Annanarivo, Sikora (det. Princis). 22. (1456 L). *Jagrehnia testacea* (Brunner) (det. Princis). 23. (123 ANSP). *Jagrehnia invis circumdata* (Rehn). Niangara, Congo (det. Rehn). 24. (1455 L). *Jagrehnia invis invis* (Rehn). Yaounde, Cameroon (det. Princis). (scale = 5 mm).

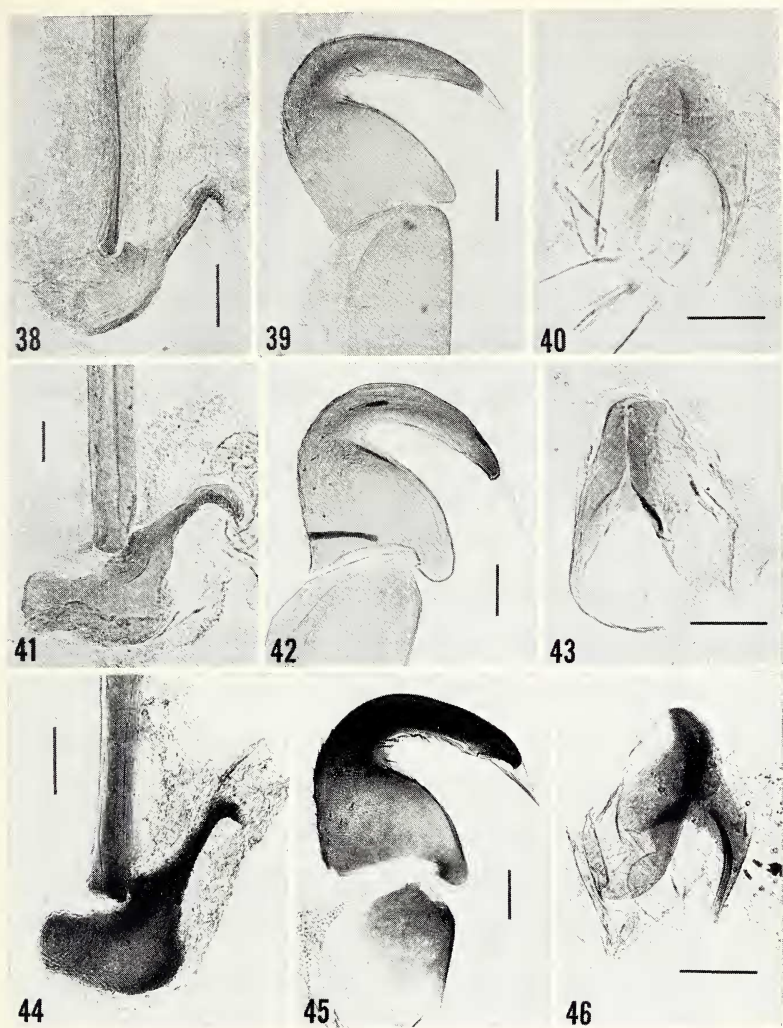


Figs. 25-28. Adult male Oxyhaloinae. 25. (173 ANSP). *Jagrehnia idonea* (Rehn) (scale = 5 mm). Paratype. Madagascar. 26. (22 BMNH). *Aeluropoda insignis* Butler. Madagascar. 27. *Gromphadorhina brunneri* Butler. Madagascar. 28. *Gromphadorhina chopardi* Lefevre. Madagascar. (Figs. 26-28, scale = 10 mm).





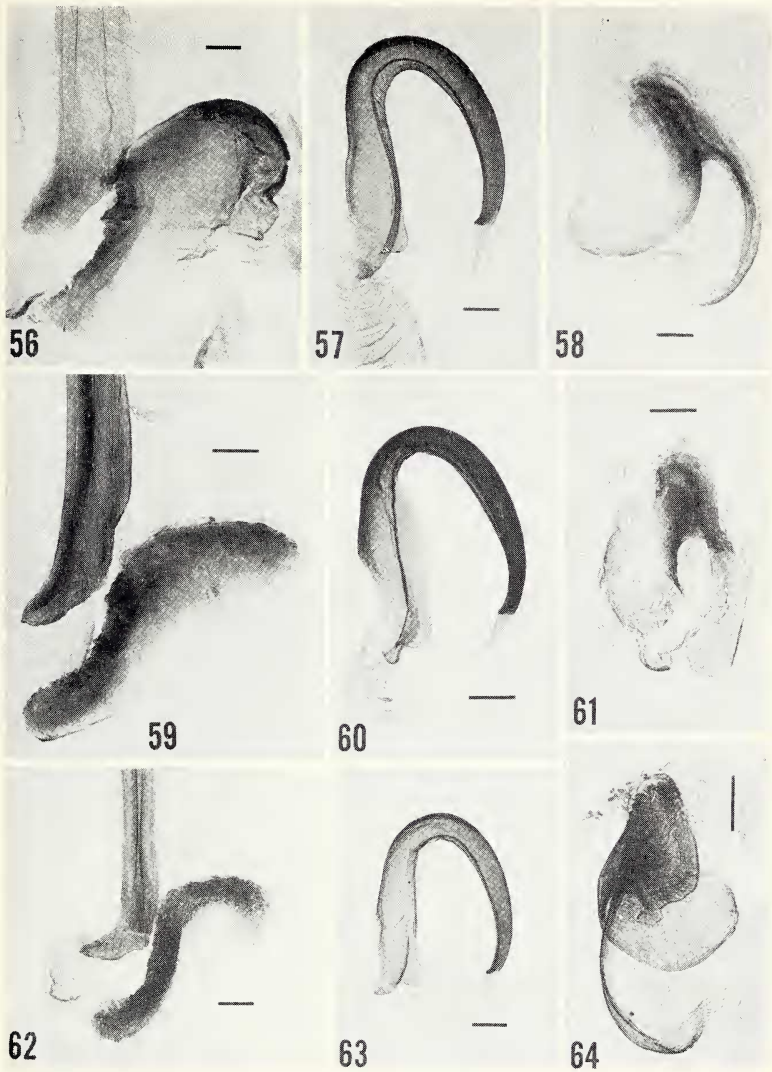
Figs. 29-37. Male cockroach genitalia of *Oxyhaloa* spp. 29-31. (12 CUZM). *O. buprestoides* (Saussure). Uganda (det. Princis). 32-34. (13 CUZM). *O. deusta* (Thunberg). East Congo (det. Princis). 35-37. (42 BMNH). *O. ferreti* Reiche and Fairemaire. Samburu District (det. Chopard). (scale = 0.2 mm).



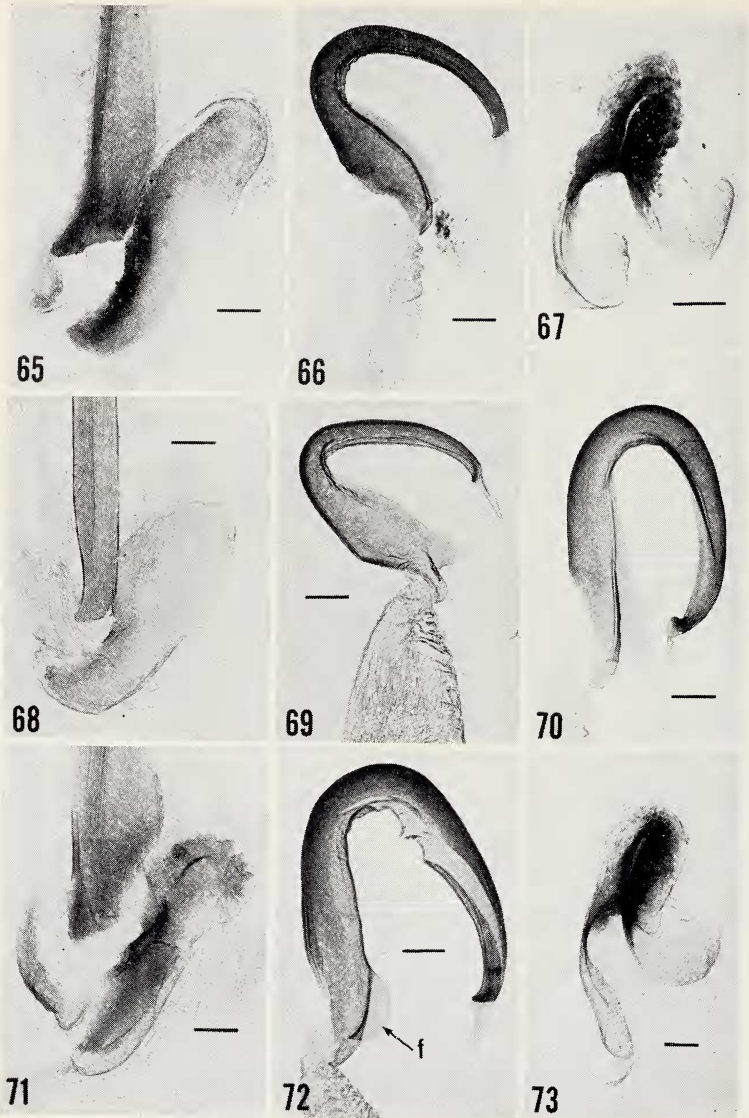
Figs. 38-46. Male cockroach genitalia of *Oxyhaloa* spp. 38-40. (1448 L). *O. perspicua* Shelford. Bingerville, Ivory Coast (det. Princis). 41-43. (14 CUZM). 44-46. (1449 L). *O. minima*. Kribi, South Cameroon (det. Princis). (scale = 0.1 mm).



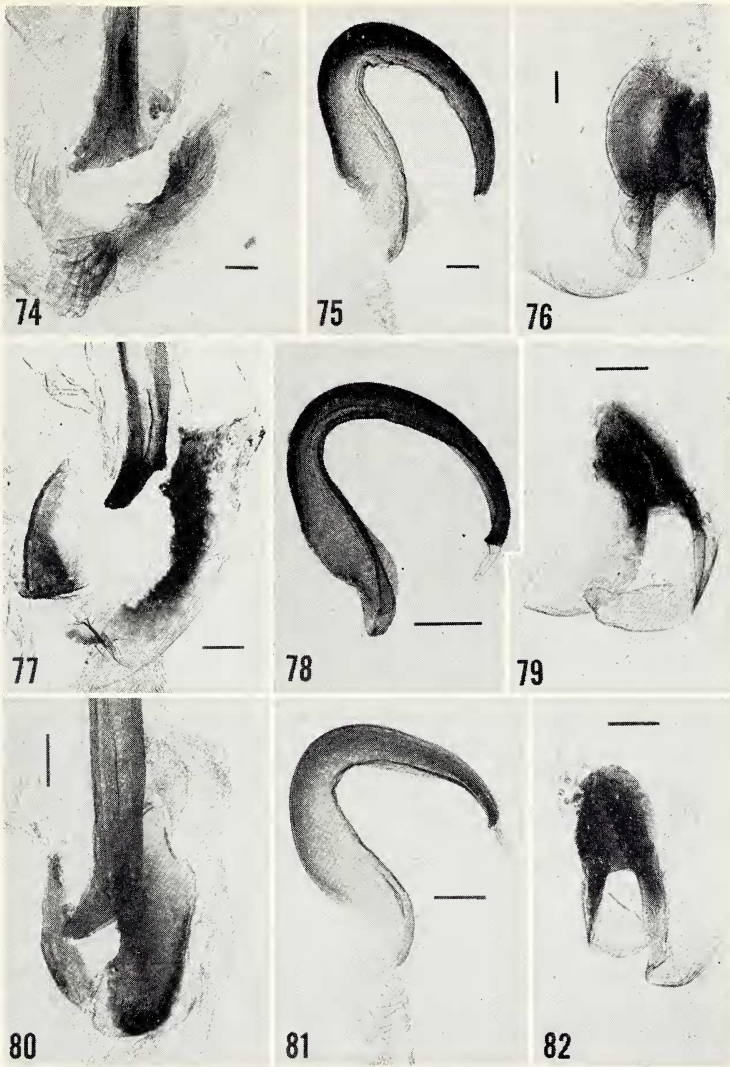
Figs. 47-55. Male cockroach genitalia of Oxyhaloinae. 47-49. (N). *Griffiniella larvalis* Princis. 50-53. (N). *Nauphocta cinerea* (det. Roth). 54-55. (3 CSIRO). *N. cinerea*. Australia (det. Roth). (scale, Figs. 47-49 = 0.1 mm, Figs. 50-55 = 0.2 mm).



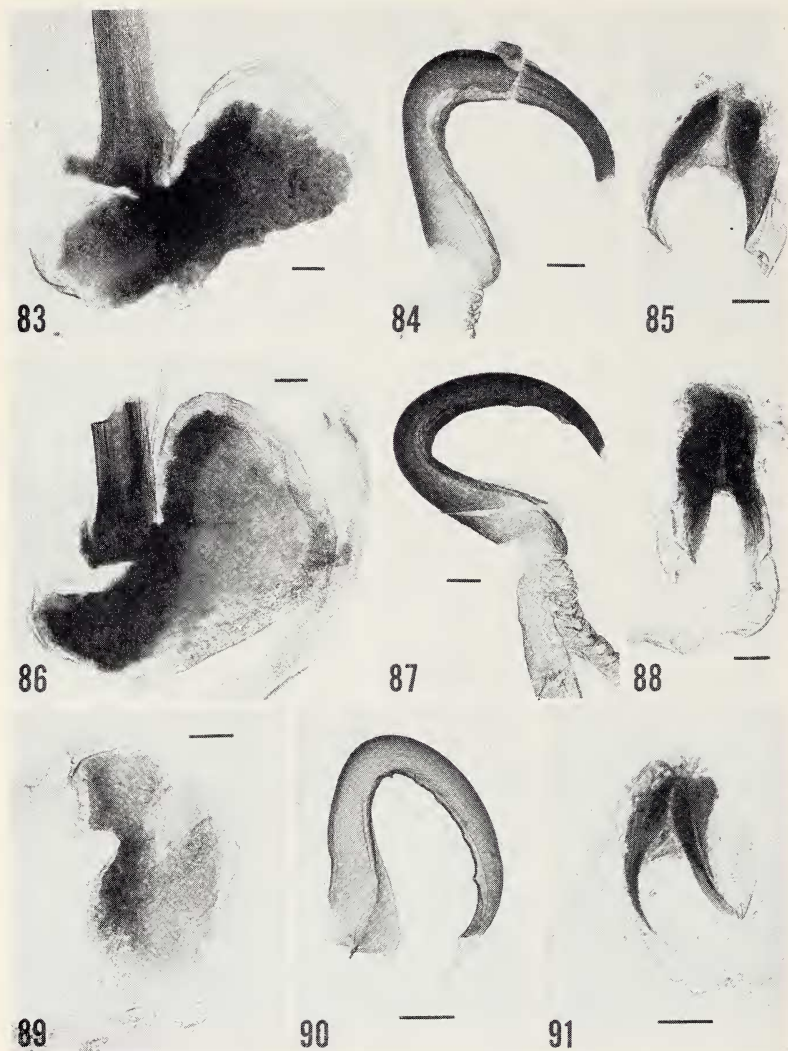
Figs. 56-64. Male cockroach genitalia of *Henschoutdenia* spp. 56-58. (133 ANSP). *H. epilamproides* (from specimen shown in Fig. 12). 59-61. (30 CUZM). *H. flexivitta*. Gubi, East Congo (det. Princis). 62-64. (27 MCZ). *H. flexivitta*. Biteye Ja River, Cameroon, West Africa (det. Rehn). (scale = 0.2 mm).



Figs. 65-73. Male cockroach genitalia of *Henschoutedenia* spp. 65-67. (1452 L). *H. tectidoma* (from specimen shown in Fig. 11). 68-69. (188 USNM). *H. sordida* (Shelford). Allotype of *Nauphoeta procera* Rehn, a synonym. Mt. Coffee, Liberia. 70-73. *H. elegans*. 70. (28 CUZM) (from specimen shown in Fig. 7). 71-73. (135 ANSP). Lolodorf, Cameroon. (f = flange). (scale = 0.2 mm).



Figs. 74-82. Male cockroach genitalia of *Henschoutedenia* spp. 74-76. (1450 L). *H. mombutu* (from specimen shown in Fig. 8). 77-79. *H. occidentalis*. 77. (1451 L). (from specimen shown in Fig. 10). 78-79. (31 CUZM). (det. Princis). 80-82. (1453 L). *H. bicolor*. (from specimen shown in Fig. 13). (scale = 0.2 mm).

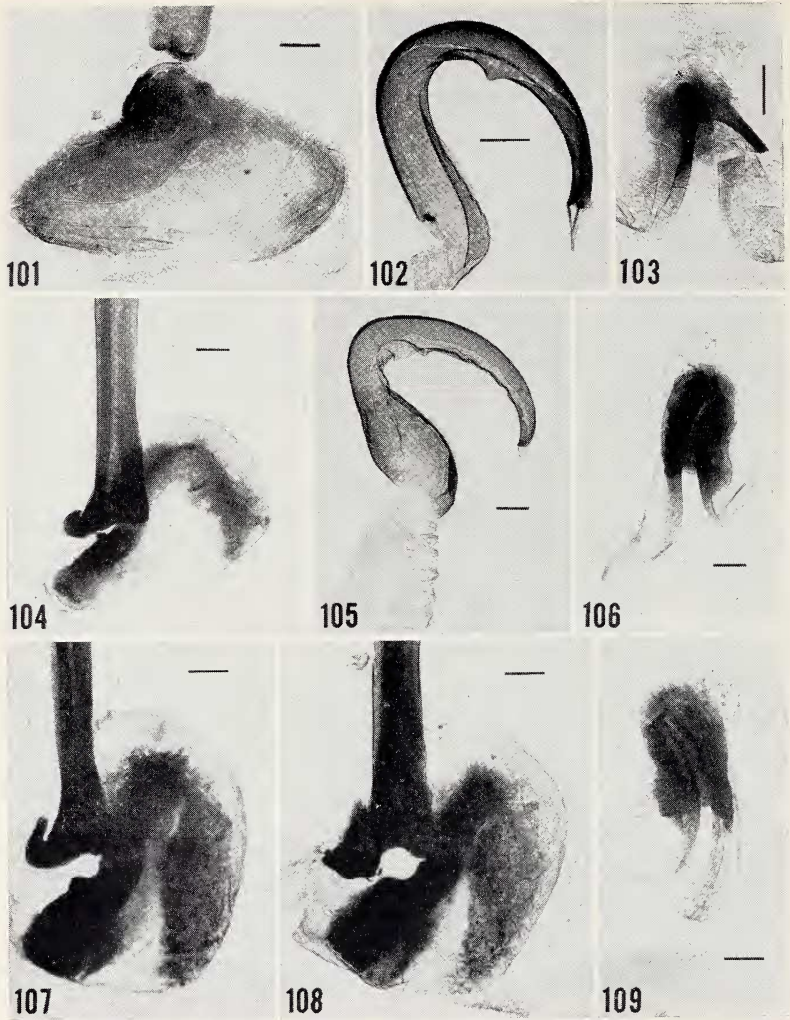


Figs. 83-91. Male cockroach genitalia of *Leucophaea* spp. 83-85. (131 ANSP). *L. capelloi*. (from specimen shown in Fig. 14). 86-88. (23 AMNH). *L. capelloi*. Niangara, Congo (det. Rehn). 89-91. (152 ANSP). *L. puerilis*. Paratype. (from specimen shown in Fig. 18). (scale = 0.2 mm).

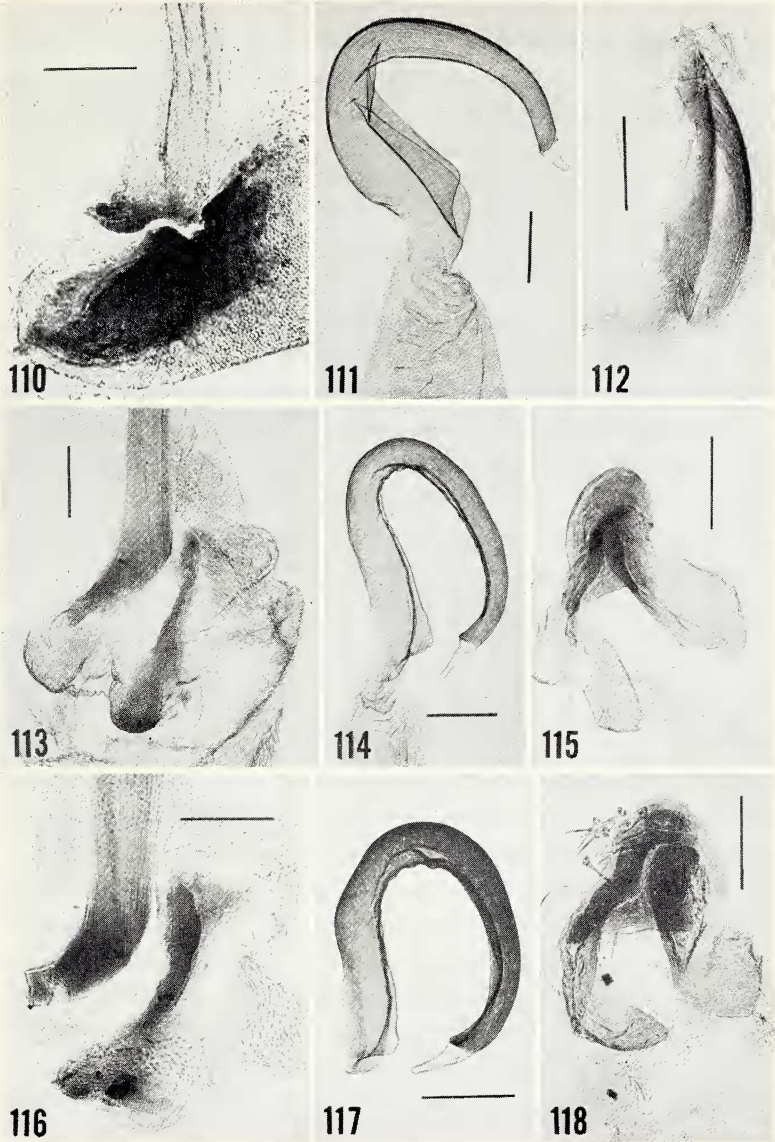


Figs. 92-100. Male cockroach genitalia of *Leucophaea* spp. 92-94. (22 AMNH). *L. grandis*. Kinshasa, Belgian Congo (det. Rehn). 95-97. (128 ANSP). *L. grandis*. (from specimen shown in Fig. 16). 98-100. (29 CUZM). *L. puerilis*. Cameroon Republic (det. Princis). (scale = 0.2 mm).

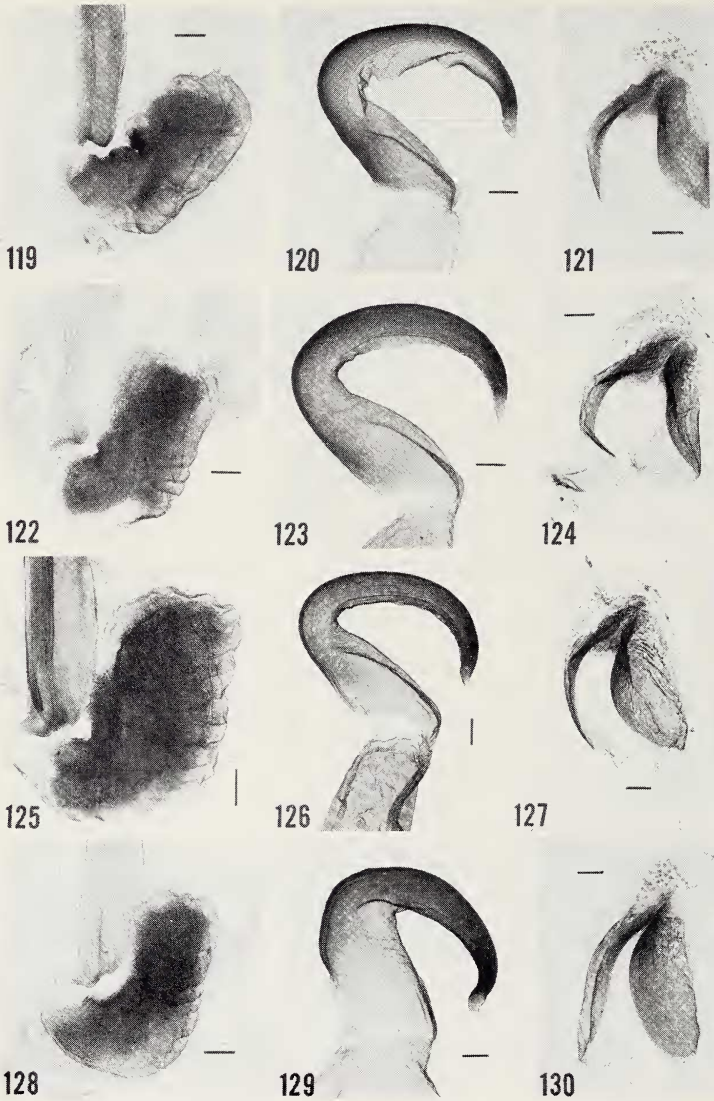




Figs. 101-109. Male cockroach genitalia of *Leucophaea* spp. 101-103. (1460 L). *L. pustulata*. (from specimen shown in Fig. 17). (det. Princis). 104-109. (N). *L. maderae* (det. Roth). (scale = 0.2 mm).



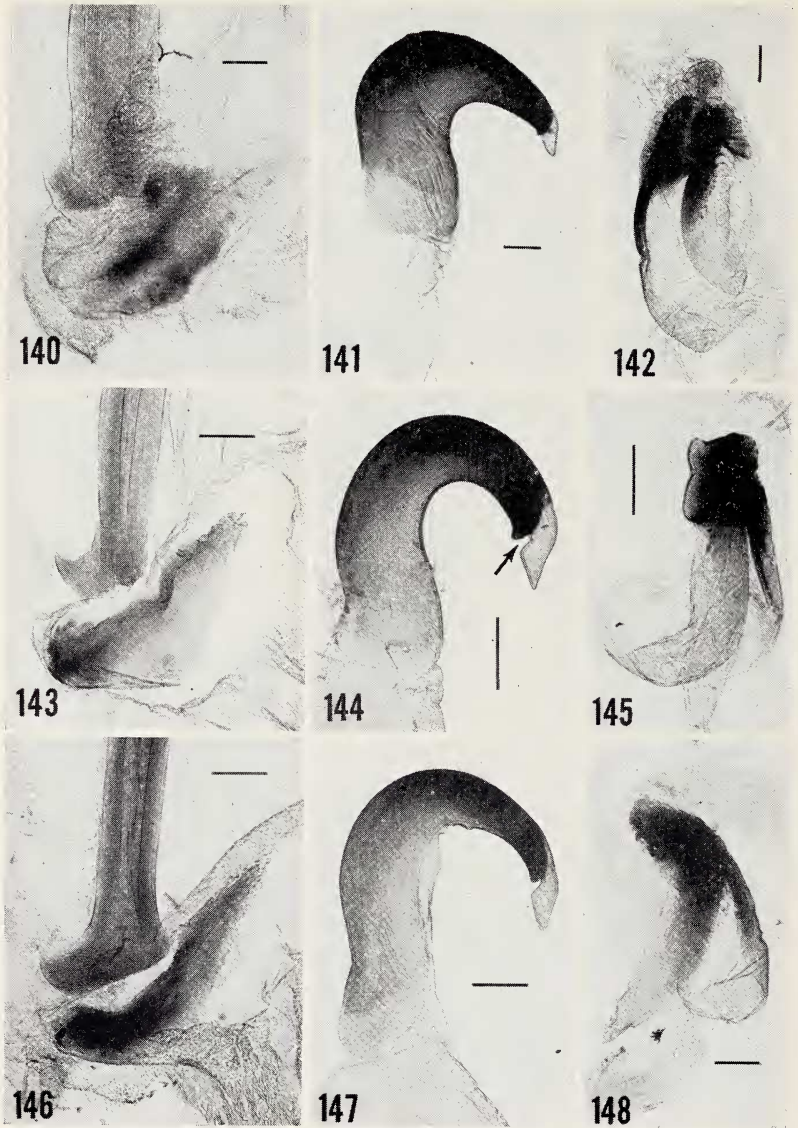
Figs. 110-118. Male cockroach genitalia of *Jagrehnia* spp. 110-112. (48 BMNH). *J. paolina* (Giglio-Tos). Kenya (det. Kevan as *Nauphoeta punctipennis* Chopard, a synonym). 113-115. (1454 L). *J. minuta*. (from specimen shown in Fig. 19) (det. Princis). 116-118. (32 CUZM). *J. minuta*. (det. Princis). (scale = 0.2 mm).



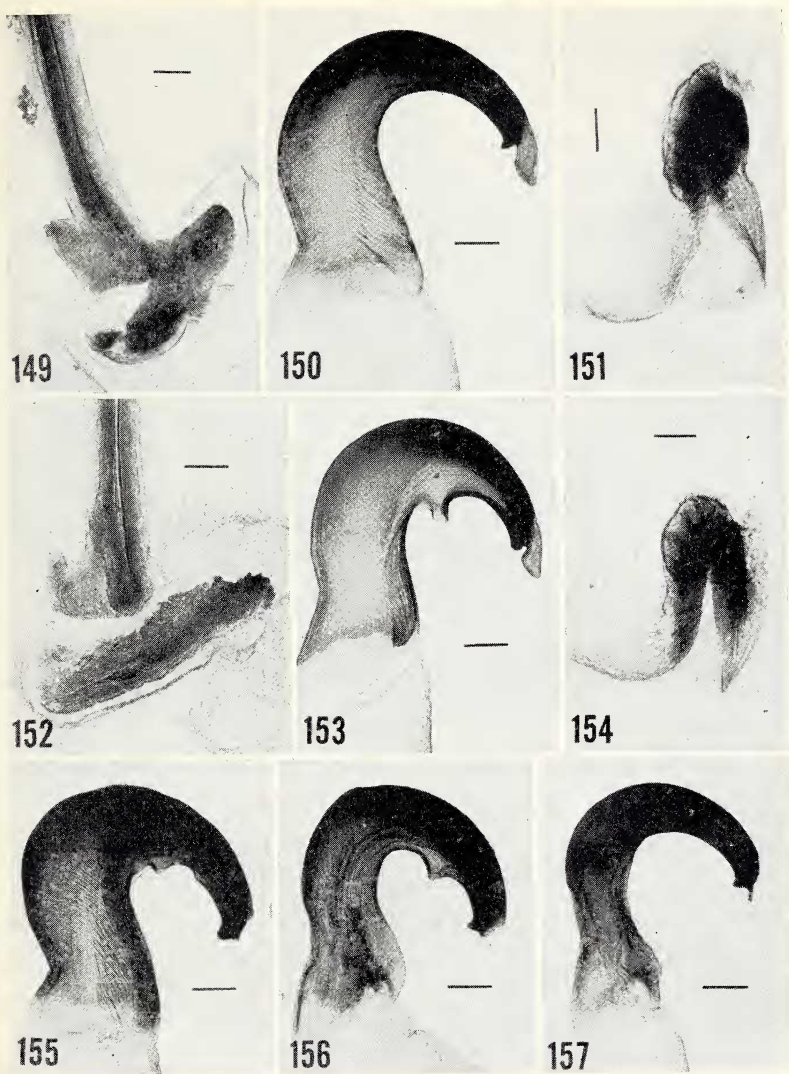
Figs. 119-130. Male cockroach genitalia of *Jagrehnia* spp. 119-121. (162 ANSP). *J. gestroiana*. (from specimen shown in Fig. 20). 122-124. (123 ANSP). *J. invisă circumdata*. (from specimen shown in Fig. 23). 125-127. (1455 L). *J. invisă invisă*. (from specimen shown in Fig. 24). 128-130. (1456 L). *J. testacea*. (from specimen shown in Fig. 22). (scale = 0.2 mm).



Figs. 131-139. Male cockroach genitalia of *Jagrelnia* spp. 131-133. (173 ANSP). *J. idonea*. (from specimen shown in Fig. 25). 134-136. (159 ANSP). *J. madecassa*. Madagascar (det. Rehn). 137-139. (1457 L). *J. madecassa*. (from specimen shown in Fig. 21). (scale = 0.2 mm).



Figs. 140-148. Male cockroach genitalia of Oxyhaloinae. 140-142. (22 BMNH). *Aeluropoda insignis*. (from specimen shown in Fig. 26). 143-145. (N). *Gromphadorhina chopardi*. Madagascar. 146-148. (N). *Gromphadorhina javanica* Saussure. Madagascar. (scale = 0.2 mm).



Figs. 149-157. Male cockroach genitalia of *Gromphadorhina* spp. 149-151. (N). *G. portentosa* (Schaum). Madagascar. 152-156. (N). *G. brunneri*. Madagascar. 157. (N). *G. portentosa*. (The tips of the genital hooks in Figs. 155-157 are broken off.) (scale = 0.2 mm).

## SUMMARY

The male genitalia of 8 genera of Oxyhaloinae show remarkable basic uniformity of characters, especially in the structure of L2d and the marked reduction in L1. Differences in characters of the genital hooks (R2) were used to separate the genera into three tribes as follows:

1. Oxyhaloini. — *Oxyhaloa*.
2. Nauphoetini. *Nauphoeta*, *Griffiniella*, *Henschoutedenia*, *Leucophaea*, and *Jagrehnia*.
3. Gromphadorhinini. — *Gromphadorhina* and *Aeluropoda*.

## ACKNOWLEDGMENTS

I thank the following for the loan of museum material: Dr. N. Jago, Academy of Natural Sciences, Philadelphia, Dr. Jerome G. Rozen, Jr., American Museum of Natural History, New York, Dr. David R. Ragge, British Museum (Natural History), London, Dr. S. L. Tuxen, Zoological Museum, Copenhagen, Dr. Karl Princis, Zoological Institution, Lund University, Sweden, Dr. Ashley Gurney, United States National Museum, Washington, D. C., and Dr. K. H. L. Key, CSIRO, Canberra, Australia. I also thank Mr. Sam Cohen for taking the photographs.

## REFERENCES

- BARTH, R. JR.  
1968. The mating behavior of *Gromphadorhina portentosa* (Schaum) (Blattaria, Blaberoidea, Blaberidae, Oxyhaloinae): an anomalous pattern for a cockroach. *Psyche* 75: 124-131.
- GURNEY, A. B.  
1965. Two new cockroaches of the genera *Pelmatosilpha* and *Henschoutedenia*, with a key to the West Indian species of *Pelmatosilpha* (Dictyoptera: Blattaria). *Proc. Roy. Entomol. Soc. Lond. (B)* 34: 5-11.
- McKITTRICK, F. A.  
1964. Evolutionary studies of cockroaches. *Cornell Univ. Agric. Exp. Sta. Memoir* 389, 197 pp.
- PRINCIS, K.  
1961. Zur systematik der Blattarien. *Eos* 36: 427-449.  
1965. Orthopterorum Catalogus. Pars. 7: Blattariae: Subordo Blaberoidea: Fam.: Oxyhaloidae, Panesthiidae, Cryptocercidae, Chorisonneuridae, Oulopterygidae, Diplopteridae, Anaplectidae, Archblattidae, Nothoblattidae. 's-Gravenhage pp. 284-400.
- REHN, J. A. G.  
1965. A new genus of symbiotic cockroach from southwest Africa (Orthoptera; Blattaria; Oxyhaloinae). *Notulae Naturae* No. 374: 1-8.
- ROTH, L. M.  
1970. The male genitalia of Blattaria. VIII. *Panchloria*, *Anchoblatta*, *Biolleya*, *Pelloblatta*, and *Achroblatta*. Blaberidae: Panchlorinae. *Psyche* (in press).